Information Circular 30

MAJOR WATER USE IN MISSOURI: 1986

by

Jeanette A. Barnett

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY
P.O. Box 250, Rolla, MO 65401

COVER:
Missouri River at Easley, Missouri; photo by James E. Vandike, February 22, 1984.

Information Circular 30
1989

MAJOR WATER USE IN MISSOURI: 1986

by
Jeanette A. Barnett

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY
P.O. Box 250, Rolla, MO 65401

Missouri Classification No. MO/NR. Ge 18:30

Barnett, Jeanette A., 1989, **MAJOR WATER USE IN MISSOURI: 1986:** Missouri Department of Natural Resources, Division of Geology and Land Survey, Information Circular 30, 14 p., 27 figs.

IC-30 MAJOR WATER USE IN MISSOURI: 1986

CONTENTS

INTRODUCTION

This report is a compilation of 1986 Missouri water-use data registered with the Missouri Department of Natural Resources. A law passed in 1983 by the Missouri General Assembly requires annual registration of Missouri's major water users, which are individually defined as a person, firm, or corporation having a water source and a pump capable of producing 100,000 gallons or more per day.

These data do not represent all the major water users in Missouri nor do they depict total water use in Missouri. Compliance with the law is basically voluntary; therefore, use registration is incomplete. Currently, the Missouri DNR intends to increase compliance through consistent data collection, publication of data, and public education. Effective management and planning of Missouri's water resources depend on collection of water-use data.

The USGS cooperated in contributing to collecting, reporting, and analysing these data, which are publicly accessible through the USGS national information system of water-use data.

EXPLANATION OF DATA

Collection of this data is authorized under RSMO Chapter 256.400. A major water user can be a "person, firm, corporation or the State of Missouri, its agencies or corporations and any other political subdivision of this state, their agencies or corporations, with a water source and equipment necessary to withdraw or divert 100,000 gallons of more per day from any stream, river, lake, well, spring or other water source." Each year major water users are sent a Water Use Inventory form and Source of Water form requesting the following information:

- User name and address
- Owner name and address
- Type of source: ground water, surface water, or both
- Amount of water diverted
- Amount of water returned
- Maximum rate pumped
- Method of measurement
- Type of use: domestic, municipal, irrigation, recreation, industrial, electrical generation, fish and wildlife, and drainage and dewatering

For each well the following information is requested:

- Owner name
- Date drilled
- Depth to water
- Depth of well
- Depth to bottom of casing
- Pump capacity
- Water pumped annually
- Method of measurement
- Acres irrigated
- Status
- Certification well number
- Location of withdrawal (legal description)

For each surface-water source the following information is requested:

- Name or type of water body
- Location of withdrawal (legal description)
- Water pumped annually
- Acres irrigated
- Pump capacity

Some assumptions concerning data were made for this report. When a user diverts water from both ground water and surface water, the total amount of water used is divided equally between the two sources. For example, if Cole County used 50 million gallons per year from both sources, 25 million gallons were attributed to ground water, and 25 million gallons were attributed to surface-water sources.

For this report, the total registered annual water use is represented on the state map for each type of use, by county and by source. For each water-use category, pie diagrams illustrate the amount of ground-water and surface-water use. Appendices show 1986 water-use data for each county, by use and source.

It is important to note that these data do not represent total water use in the State of Missouri. The figures are only as accurate as the information obtained from major water users who register their use.

DOMESTIC WATER USE

Domestic water use refers to water used for household purposes and subsistence, livestock watering, and irrigation of gardens and orchards not exceeding 2.5 acres. The water may come from a public supply or may be self-supplied. Use by county is shown in figures 1 and 2. Jackson County is the largest ground-water user in this category (2,834 mgy, or 8 mgd); Jasper County is the largest surface-water user (1,160 mgy, or 3 mgd). There is some overlap between the categories of domestic and municipal use, since some cities classified part of their water use as domestic and those amounts are included in this category.

A total of 11,666 mgy, or 32 mgd, was reported for domestic use. Of this, 29.3 percent came from surface-water sources and 70.7 percent from ground-water sources (fig. 3).

SURFACE WATER

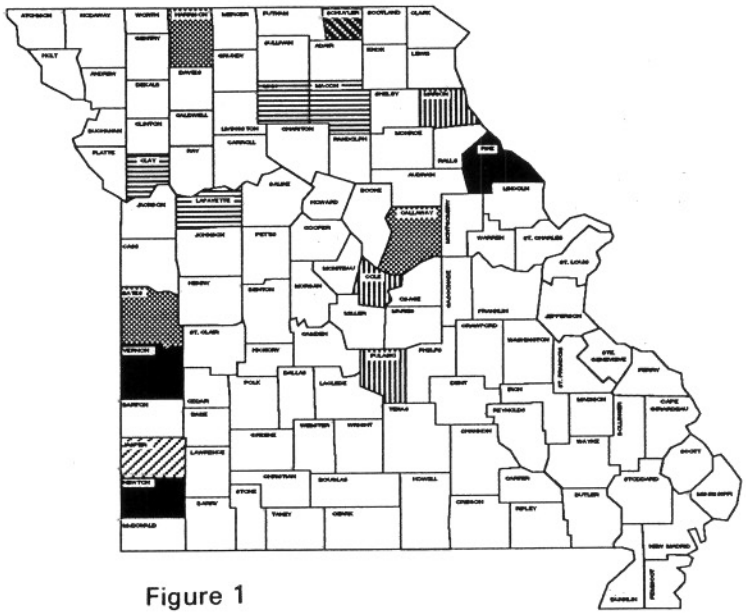


Figure 1

EXPLANATION

Range in million gallons per year

- 0-1
- 2-25
- 26-50
- 51-100
- 101-300
- 301-500
- 501-700
- 701-3000

GROUND WATER

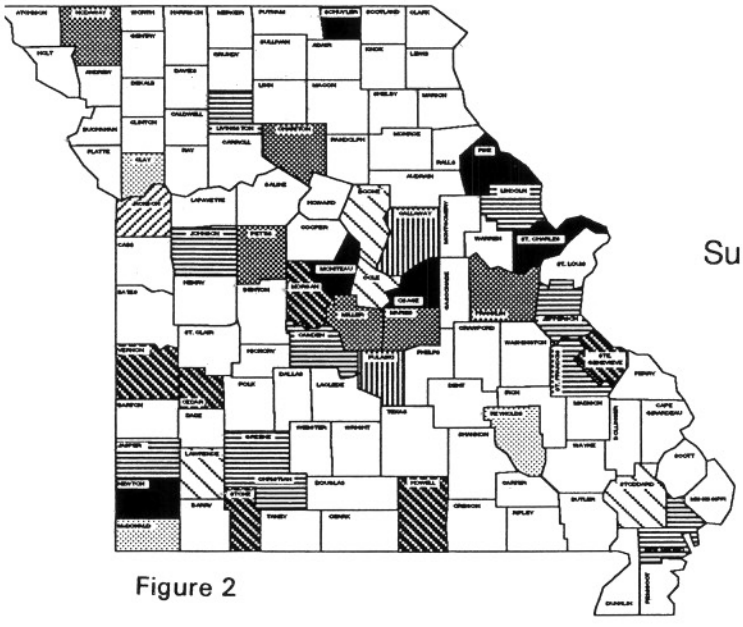


Figure 2

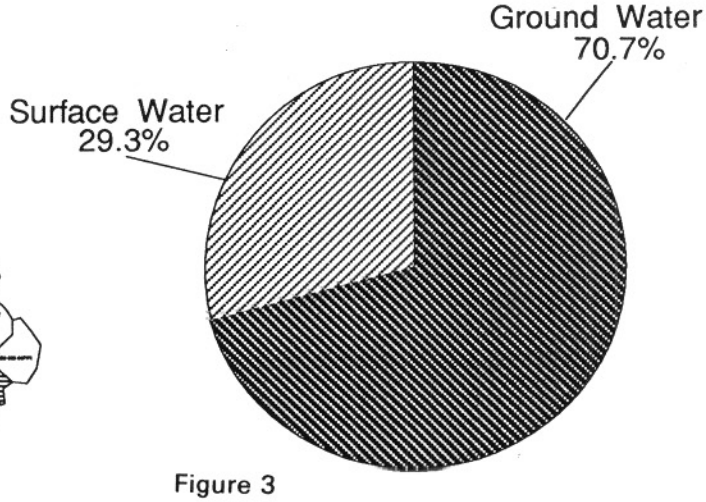


Figure 3

DRAINAGE AND DEWATERING WATER USE

Drainage and dewatering refer to such operations as evacuation of water from mines or depressions, channelization of streams, and drainage of wetlands. Effluent discharge is also included in this category. Reynolds County uses the most ground water (6,258 mgy, or 17 mgd) in this category; Iron County is the largest surface-water user (2,205 mgy, or 6 mgd). Both these counties are in the world's largest lead mining district, the Viburnum Trend, which accounts for about 94 percent of the nation's and 14 percent of the world's production. The mines also produce copper, zinc, and silver. Water use by county and location of the mining district are shown in figures 4 and 5.

A total of 9,354 mgy, or 26 mgd, was reported for drainage and dewatering. Surface-water sources provided 24.3 percent of the total use and ground-water sources 75.7 percent (fig. 6).

SURFACE WATER

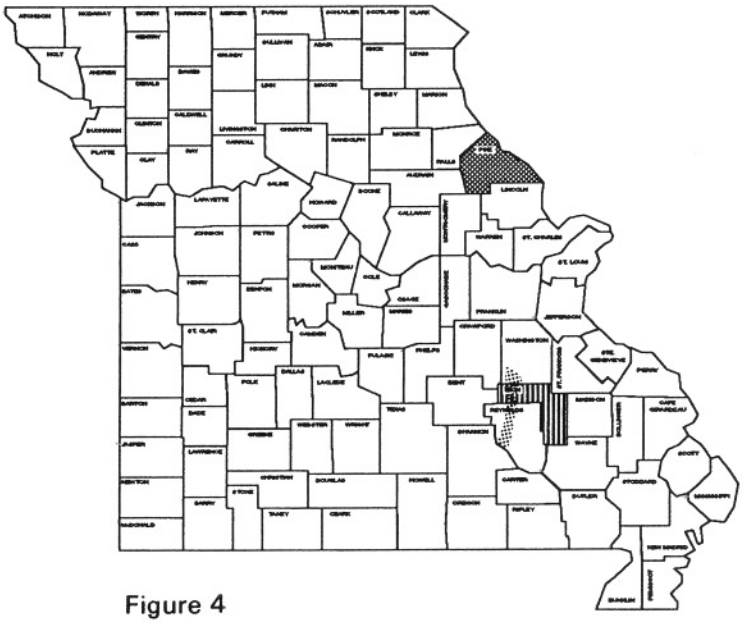


Figure 4

GROUND WATER

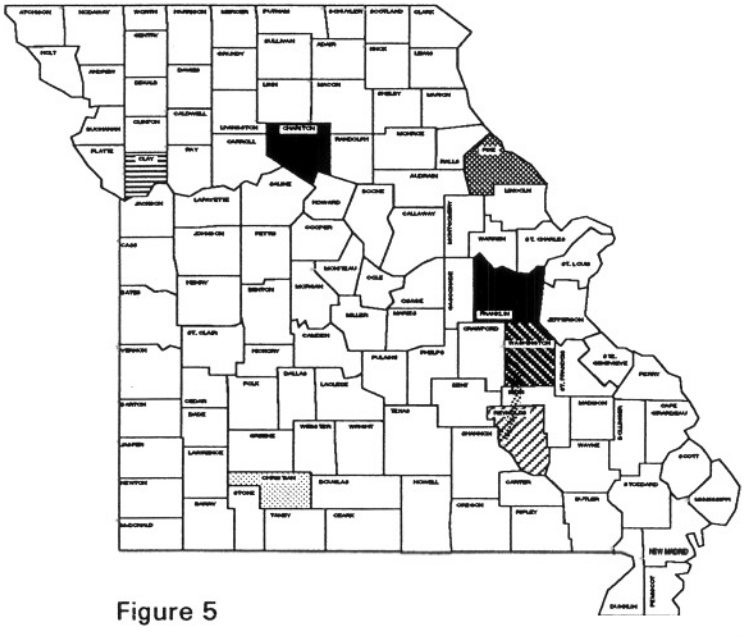


Figure 5

EXPLANATION

Range in million gallons per year

- 3-25
- 26-75
- 76-125
- 126-200
- 201-450
- 2200-4000
- 4001-6000
- 6001-6300

Viburnum Trend

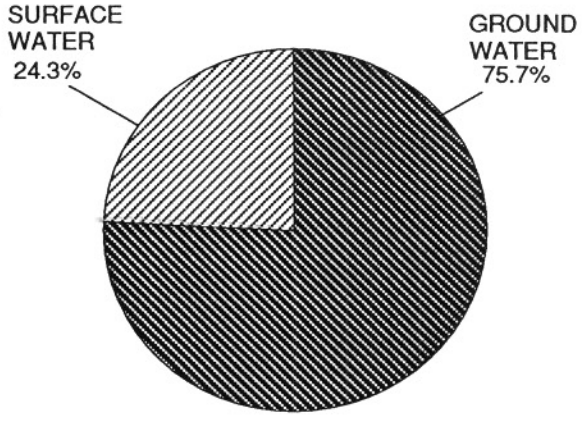


Figure 6

ELECTRICAL GENERATION WATER USE

Electrical generation water uses include hydropower dams, free-flow turbines, thermal or nuclear generation, pumped storage operations, pollution abatement, or other associated needs for producing electrical energy. This is the largest category of water use; however, very little of this water is consumed, since most is used for cooling and then returned to the water source. Use by county is shown in figures 7 and 8. Franklin County uses the most ground water (201,663 mgy, or 553 mgd) in this category. In surface-water use, Miller County ranks first (4,470,000 mgy, or 12,247 mgd) and Benton County ranks second (2,900,000 mgy, or 7,945 mgd).

Water used for electrical generation totalled 8,079,668 mgy, or 22,136 mgd. Surface-water sources provided 96.4 percent of the total use and ground-water sources 3.6 percent (fig. 9).

SURFACE WATER

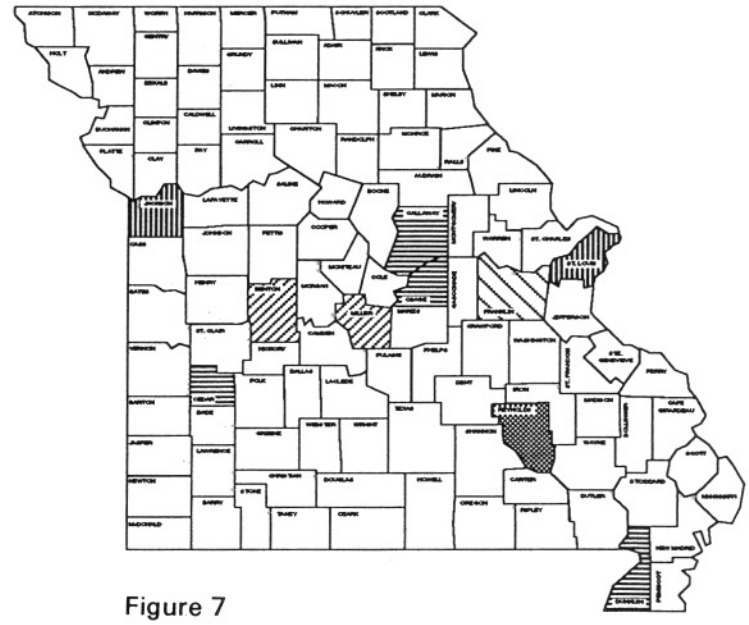


Figure 7

EXPLANATION

Range in million gallons per year

- 0-25
- 26-250
- 251-500
- 501-1000
- 1,001-50,000
- 50,001-100,000
- 100,001-250,000
- 250,001-4,500,000

GROUND WATER

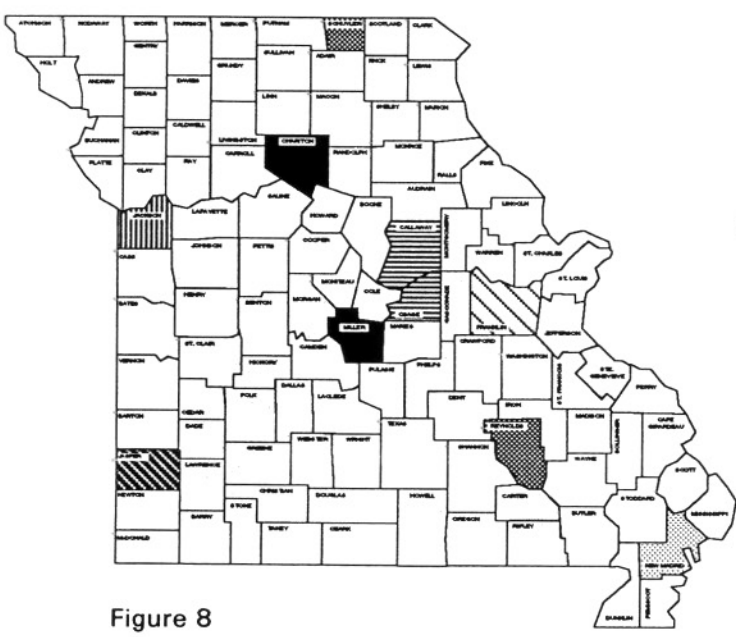


Figure 8

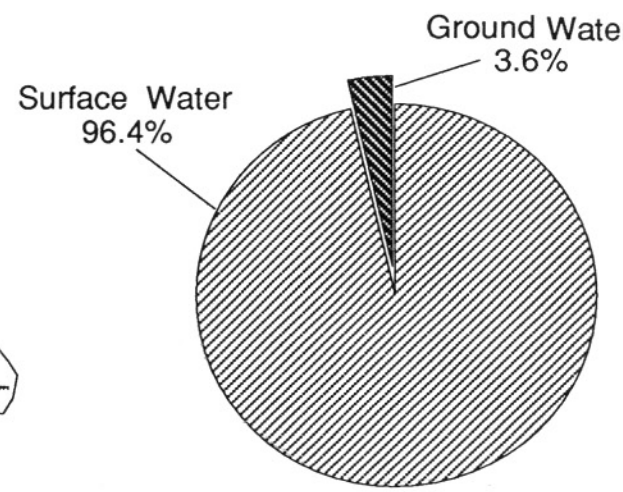


Figure 9

FISH AND WILDLIFE WATER USE

Fish and wildlife water use refers to water used for the maintenance of fish and wildlife habitats, and includes private or public fish hatcheries. Figures 10 and 11 show use by county. Holt County is the largest ground-water user in this category (43 mgy, or 0.1 mgd); Laclede County uses the most surface water (7,300 mgy, or 20 mgd).

A total of 26,545 mgy, or 73 mgd, was reported for fish and wildlife use. Surface-water sources provided 99.7 percent of the total use and ground-water sources 0.3 percent (fig. 12).

SURFACE WATER

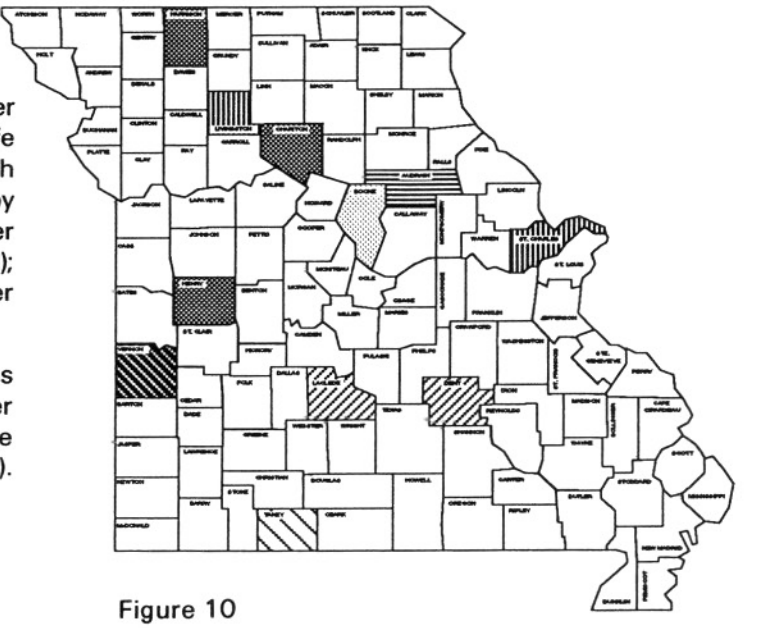


Figure 10

EXPLANATION

Range in million gallons per year

- 0.5-1
- 2-10
- 11-25
- 26-50
- 51-100
- 1000-3000
- 3001-6000
- 6001-10,000

GROUND WATER

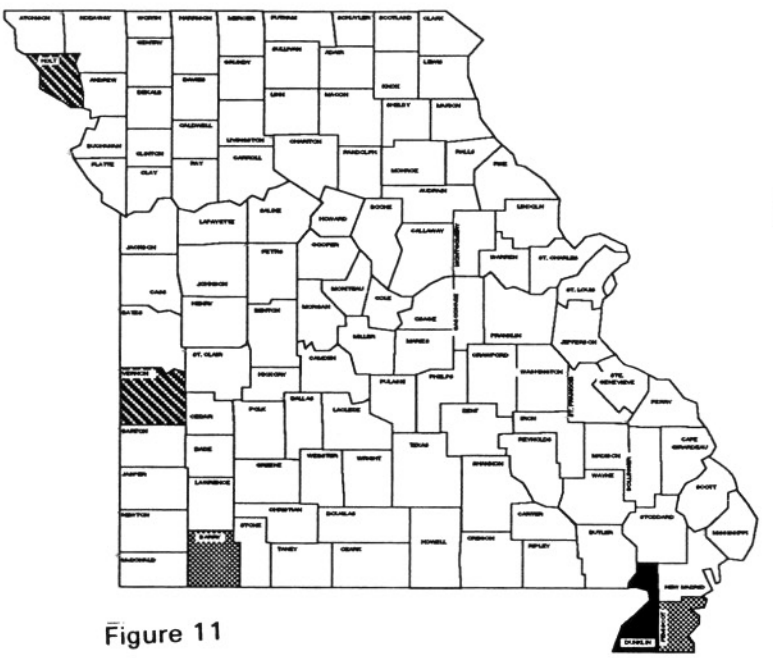


Figure 11

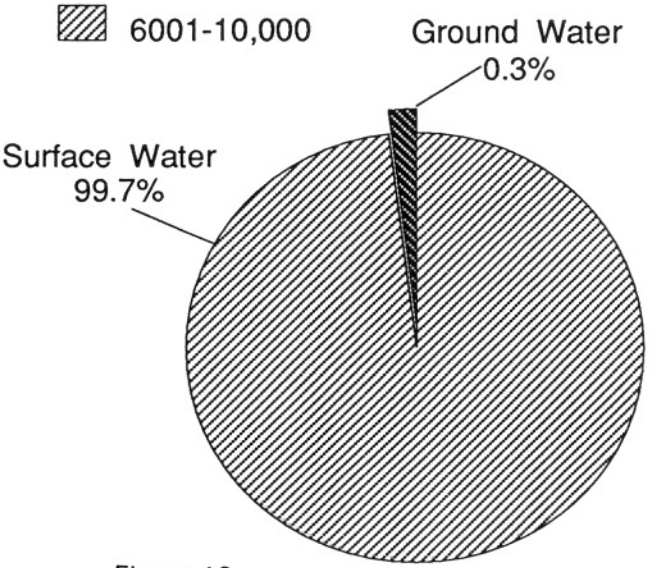


Figure 12

INDUSTRIAL WATER USE

Industrial water use aids in producing marketable products. Some examples are mining, manufacturing, and commercial poultry and livestock feedlot operations; also included are uses for which water is injected in the ground, such as hydrocarbon displacement. Ground-water and surface-water use by county are shown in figures 13 and 14. The largest ground-water users in this category are Jackson County (1,894 mgy, or 5 mgd) and Washington County (1,413 mgy, or 4 mgd). The biggest surface-water users are Jackson County (3,125 mgy, or 9 mgd) and St. Louis County (2,091 mgy, or 6 mgd).

Total reported industrial water use was 17,620 mgy, or 48 mgd. Of this, 55.3 percent came from surface-water sources and 44.7 percent from ground-water sources (fig. 15).

SURFACE WATER

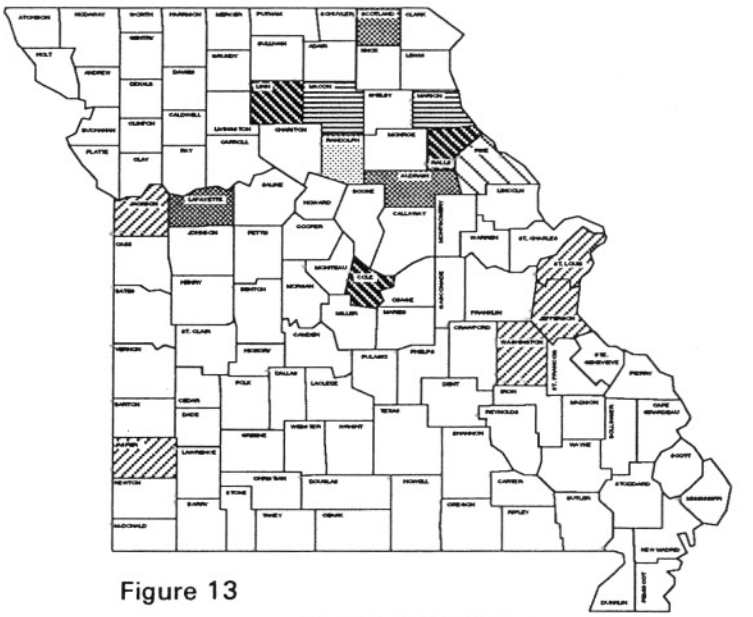
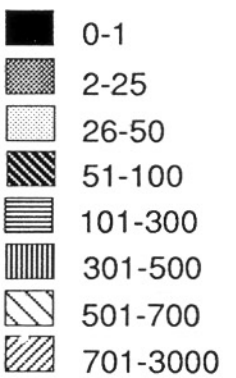


Figure 13

EXPLANATION

Range in million gallons per year



GROUND WATER

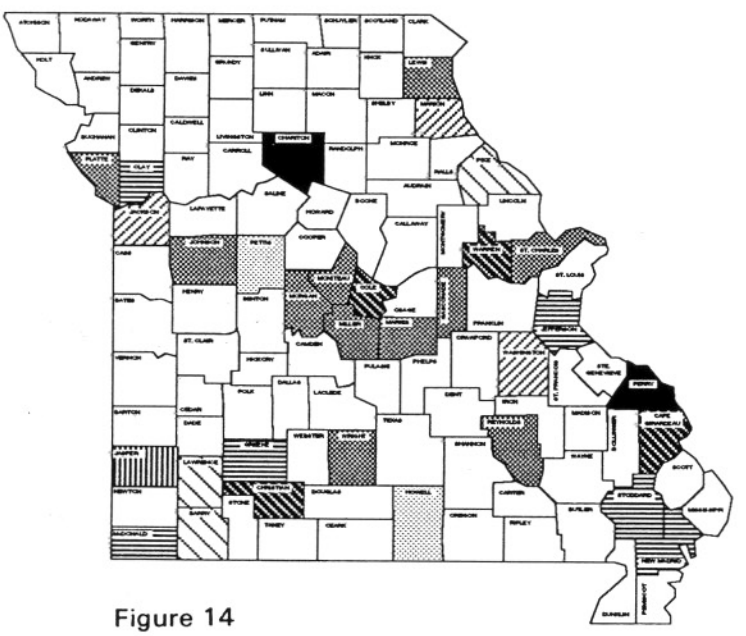


Figure 14

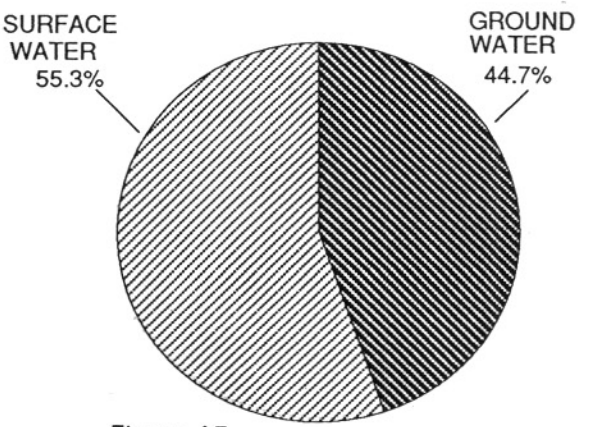


Figure 15

IRRIGATION

Irrigation is defined in this report as water needed to supplement plant growth on land of more than 2.5 acres. It is the third largest category of water use. Figures 16 and 17 show irrigation amounts by county. Butler County uses the largest amount of ground water for irrigation (20,922 mgy, or 57 mgd). Other counties using large amounts of ground water are New Madrid (14,571 mgy, or 40 mgd), Stoddard (3,375 mgy, or 9 mgd), Dunklin (2,013 mgy, or 6 mgd), and Pemiscot (1,975 mgy, or 5 mgd). All the above counties are in the Bootheel, where climate, soil, and comparatively inexpensive alluvial wells promote irrigation. Jasper County is the biggest surface-water user, (879 mgy, or 2 mgd); Audrain County is second (612 mgy, or 2 mgd).

Total reported irrigation water use was 48,669 mgy, or 133 mgd. Of this, 5.6 percent came from surface-water sources and 94.4 percent from ground-water sources (fig. 18). It is important to realize, however, that these irrigation figures are highly suspect, because practically all irrigators estimated their water use; very few used meters.

SURFACE WATER

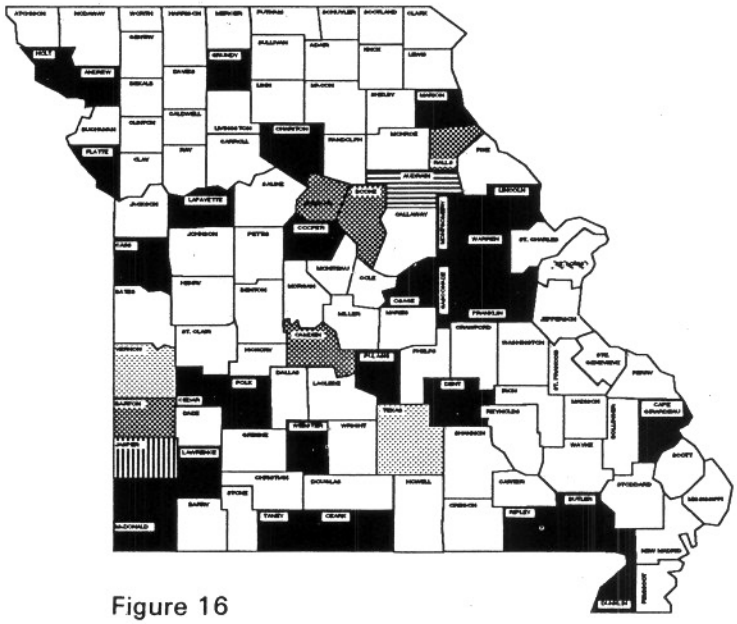


Figure 16

EXPLANATION

Range in million gallons per year

- 0-50
- 51-100
- 101-300
- 301-500
- 501-700
- 701-1000
- 1,001-10,000
- 10,001-21,000

GROUND WATER

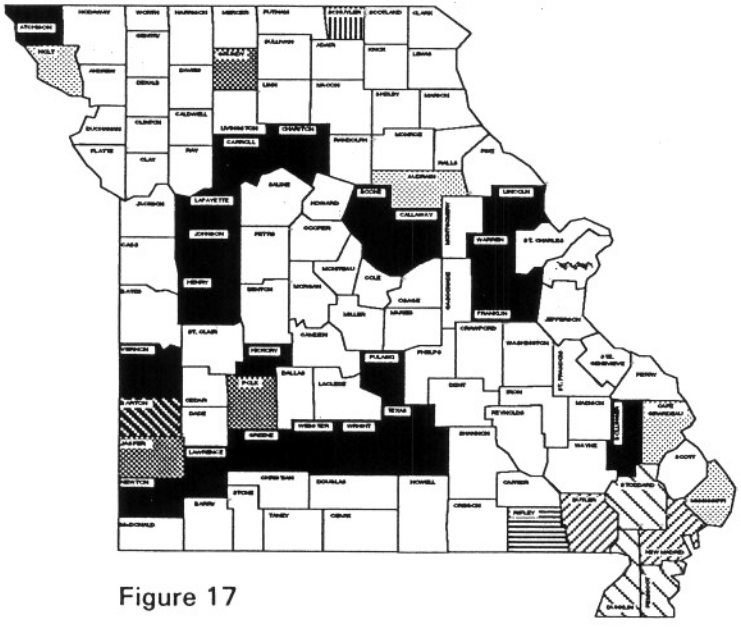


Figure 17

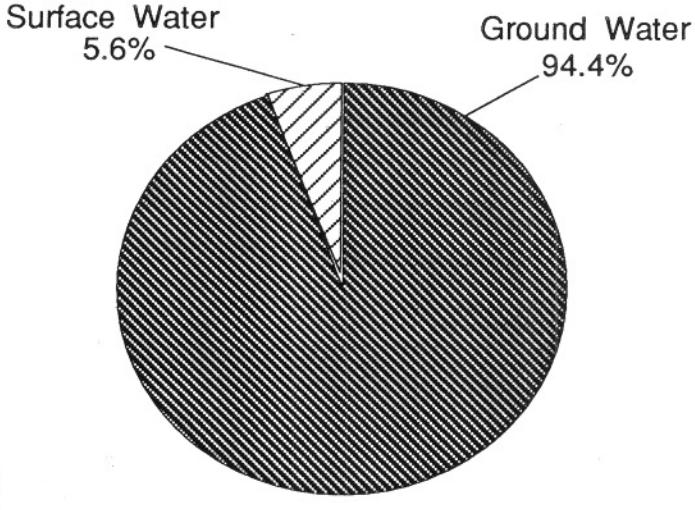


Figure 18

MUNICIPAL WATER USE

Municipal water use, the second largest category, is defined as providing water for public consumption for communities, subdivisions, rural water districts, trailer courts, etc. Ground-water and surface-water use by county are shown in figures 19 and 20. The largest ground-water users are St. Charles County (4,510 mgy, or 12 mgd) and Jackson County (3,895 mgy, or 11 mgd). In surface-water use, St. Louis City ranks first (54,959 mgy, or 151 mgd); St. Louis County ranks second (53,762 mgy, or 147 mgd).

Total reported municipal water use was 157,940 mgy, or 433 mgd. Surface-water sources provided 79.3 percent of the total use and ground-water sources 20.7 percent (fig. 21).

SURFACE WATER

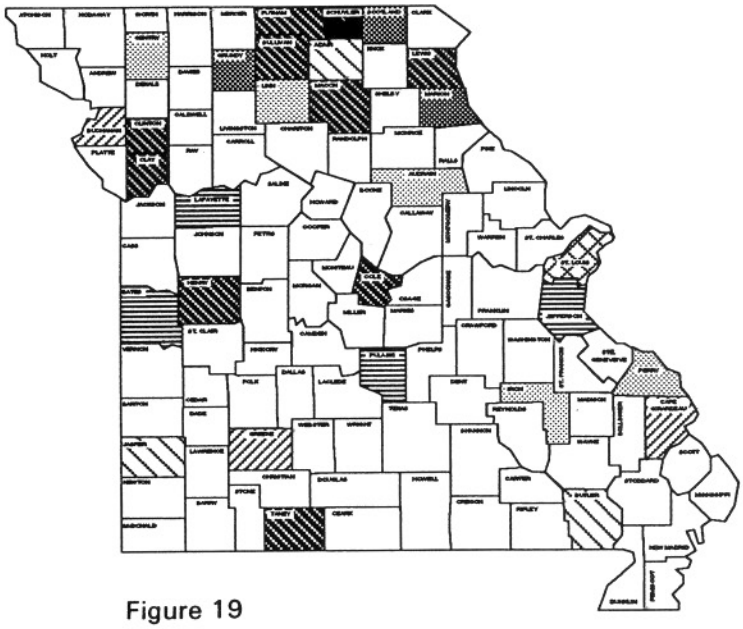


Figure 19

EXPLANATION

Range in million gallons per year

- 0-1
- 2-50
- 51-100
- 101-300
- 301-500
- 501-700
- 701-1,000
- 1,000-5,500
- 53,000-55,000

GROUND WATER

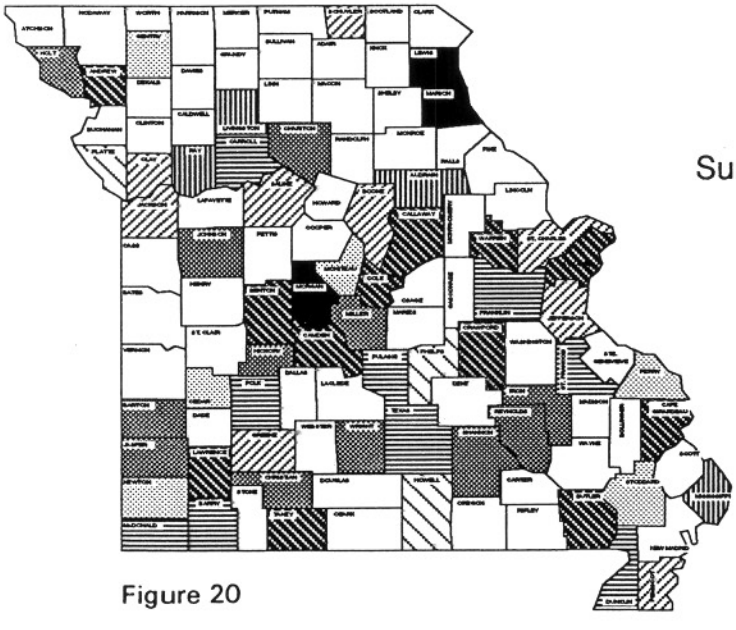


Figure 20

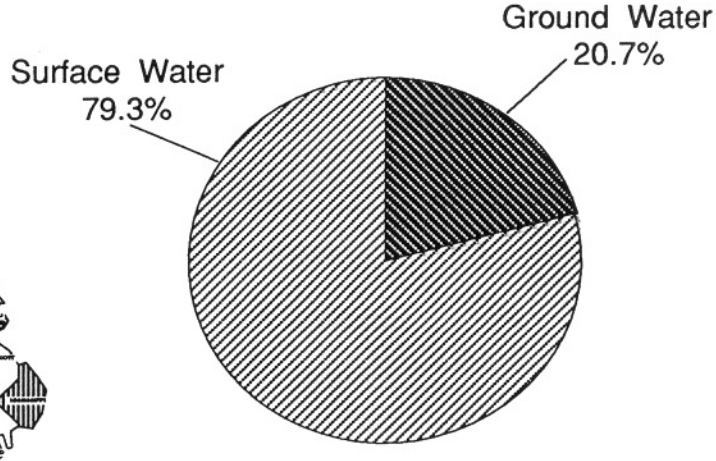


Figure 21

RECREATIONAL WATER USE

Recreational water use is defined as water used for swimming, boating, game fishing, etc. Use by county is shown in figures 22 and 23. Maries County used the most ground water in this category (704 mgy, or 2 mgd). Audrain County used the largest amount of surface water (2 mgy, or 0.004 mgd).

Total reported recreational water use was 747 mgy, or 2 mgd. Surface-water sources provided 0.3 percent of the total use and ground-water sources 99.7 percent (fig. 24).

SURFACE WATER

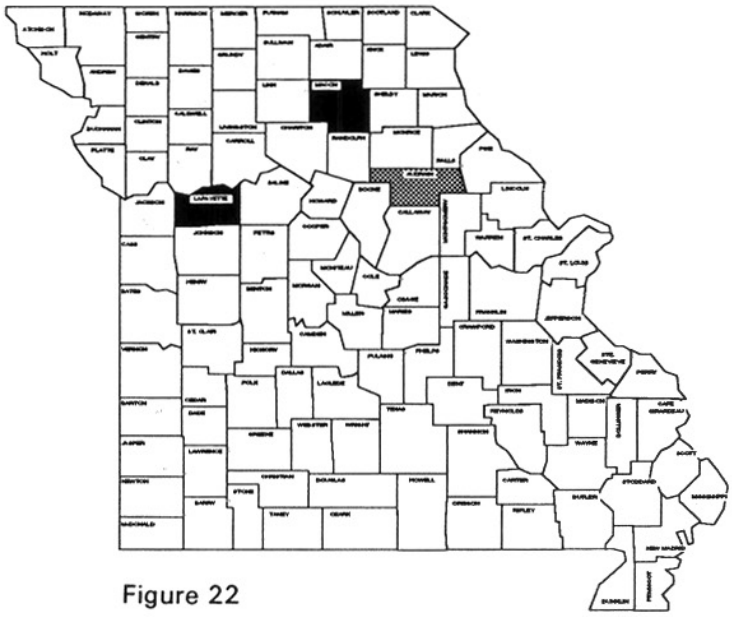


Figure 22

EXPLANATION

Range in million gallons per year

- 0-1
- 2-25
- 26-50
- 26-50
- 51-100
- 101-300
- 301-500
- 501-704

GROUND WATER

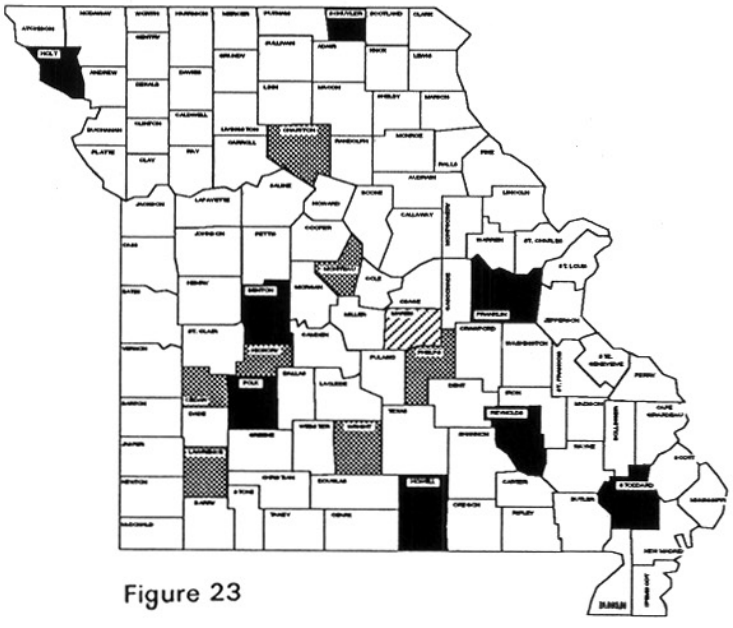


Figure 23

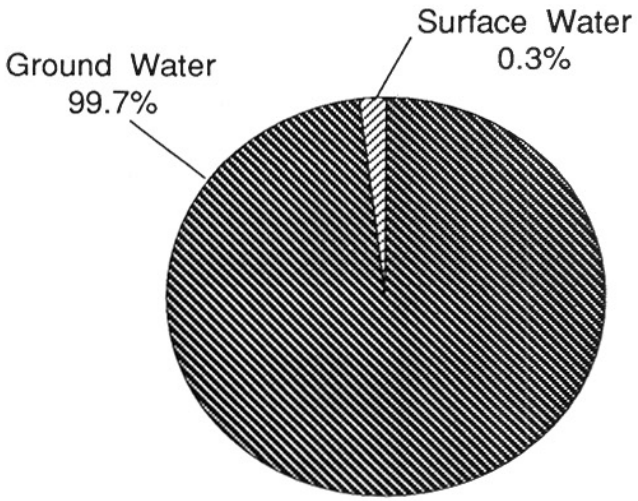


Figure 24

COMPARISON OF GROUND-WATER USE TO SURFACE-WATER USE

A total of 8,352,209 mgy, or 22,883 mgd, was registered with the Missouri Department of Natural Resources in 1986. Five percent of this total came from ground-water sources and 95 percent from surface-water sources. Figure 25 illustrates the percentages of ground-water and surface-water use minus electrical generation water use. Surface-water use among seven of the eight water use categories is shown by percent in figure 26 and ground-water use in figure 27. Electrical generation is by far the largest category of water use but consumes very little water; to prevent distorting the percentages, it is not shown on any of the pie diagrams on this page.

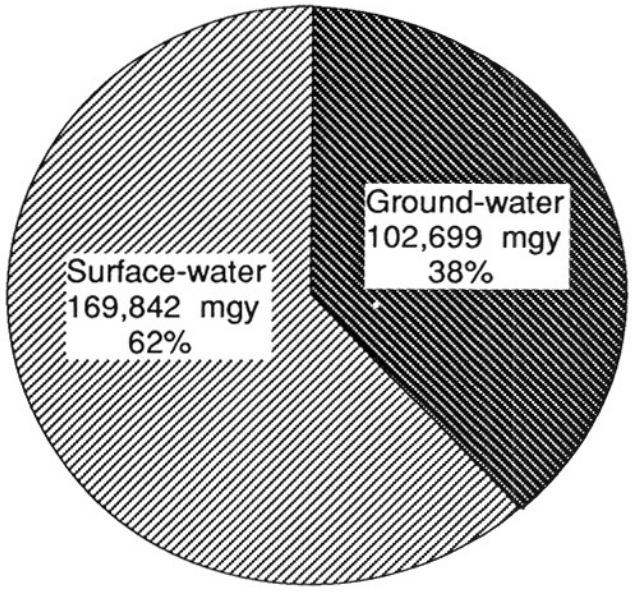
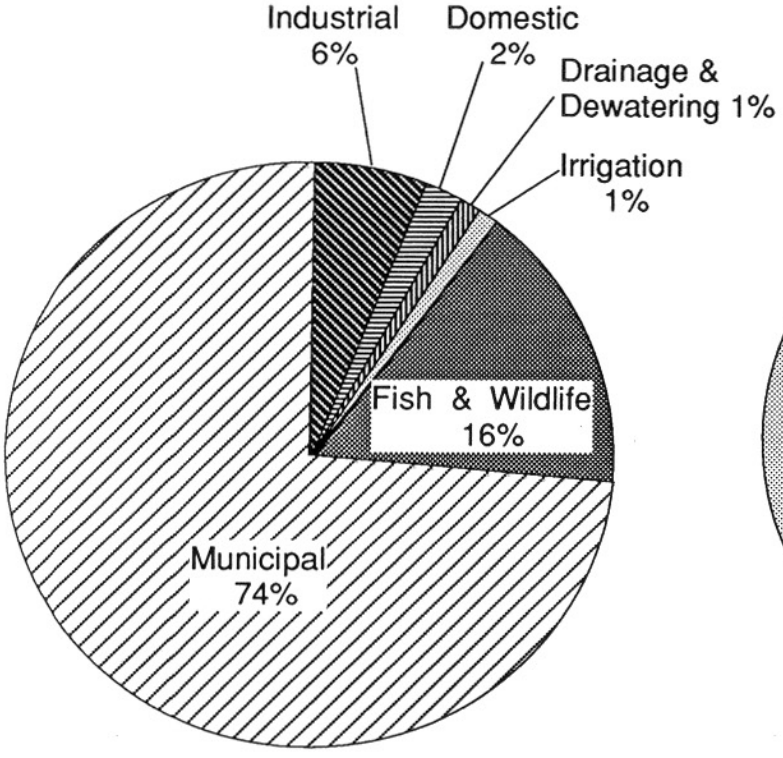
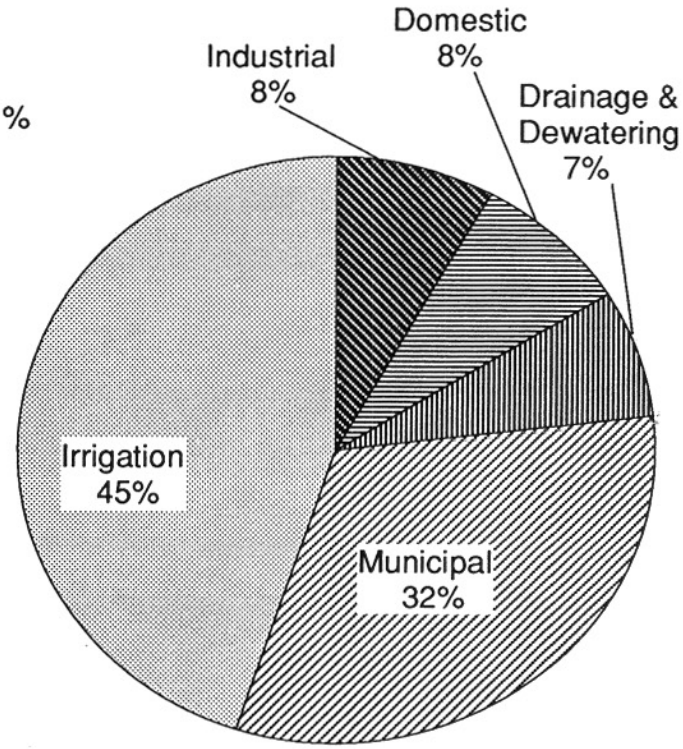


Figure 25 Total registered water use, minus electrical generation, by source in million gallons per year and percent.



Recreation (.001%) is too small to be shown on diagram

Figure 26 Total surface-water use, minus electrical generation, by category and percent.



Recreation (.73%) Fish and Wildlife (.08%) too small too be shown on diagram

Figure 27 Total ground-water use, minus electrical generation, by category and percent.

APPENDIX A

1986 GROUND-WATER USE BY COUNTY

(in million gallons per year)

County	Domestic	Municipal	Irrigation	Acres	Recreation	Industrial	Electrical	Fish and Wildlife	Drainage	Totals*
Andrew	0	168	0	0	0	0	0	0	0	168
Atchison	0	0	15	558	0	0	0	0	0	15
Audrain	0	601	194	1,930	0	0	0	0	0	795
Barry	0	428	0	0	0	544	0	4	0	972
Barton	0	47	354	2,357	0	0	0	0	0	401
Benton	0	115	0	0	.2	0	0	0	0	115
Bollinger	0	0	28	312	0	0	0	0	0	28
Boone	573	3,680	20	440	0	0	0	0	0	4,273
Butler	0	111	20,922	38,656	0	0	0	0	0	21,033
Callaway	332	145	46	480	0	0	7,358	0	0	7,881
Camden	171	177	0	0	0	0	0	0	0	348
Cape Girardeau	0	174	293	922	0	88	0	0	0	555
Carroll	0	465	19	135	0	0	0	0	0	484
Cedar	75	53	0	0	2	0	0	0	0	130
Chariton	19	6	14	123	6	.7	21	0	3	70
Christian	189	37	0	0	0	91	0	0	105	422
Clay	50	1,092	0	0	0	154	0	0	446	1,742
Cole	513	162	0	0	0	52	0	0	0	727
Crawford	0	147	0	0	0	0	0	0	0	147
Dunklin	0	467	2,013	7,164	0	0	0	.5	0	2,481
Franklin	1	340	37	500	.2	0	201,663	0	24	202,065
Gasconade	0	0	0	0	0	10	0	0	0	10
Gentry	0	59	0	0	0	0	0	0	0	59
Greene	298	3,745	10	5	0	170	0	0	0	4,224
Grundy	0	0	58	492	0	0	0	0	0	58
Henry	0	0	4	60	0	0	0	0	0	4
Hickory	0	26	15	300	2	0	0	0	0	43
Holt	0	46	130	420	.5	0	0	43	0	219
Howell	73	734	0	0	.4	27	0	0	0	835
Iron	0	27	0	0	0	0	0	0	0	27
Jackson	2,834	3,895	0	0	0	1,894	71,618	0	0	80,241
Jasper	291	21	59	0	0	364	896	0	0	1,631
Jefferson	196	1,174	0	0	0	176	0	0	0	1,546
Johnson	293	17	11	35	0	19	0	0	0	340
Lafayette	0	0	9	112	0	0	0	0	0	9
Lawrence	522	136	19	80	21	607	0	0	0	1,306
Lewis	0	.09	0	0	0	17	0	0	0	17
Lincoln	120	0	43	200	0	0	0	0	0	163
Livingston	132	570	0	0	0	0	0	0	0	703
McDonald	39	414	0	0	0	146	0	0	0	599
Maries	2	0	0	0	704	4	0	0	0	709
Marion	0	.09	0	0	0	877	0	0	0	877
Miller	6	7	0	0	0	6	3	0	0	22
Mississippi	0	539	171	1,024	0	0	0	0	0	711
Moniteau	.2	63	0	0	1	8	0	0	0	73
Morgan	92	.2	0	0	0	21	0	0	0	113
New Madrid	199	0	14,571	30,600	0	260	253	0	0	15,282
Newton	.4	91	18	150	0	0	0	0	0	109
Nodaway	2	0	0	0	0	0	0	0	0	2
Osage	.9	0	0	0	0	0	5,103	0	0	5,104
Pemiscot	0	1,200	1,975	8,572	0	0	0	4	0	3,179
Perry	0	86	0	0	0	.8	0	0	0	87
Pettis	3	0	0	0	0	31	0	0	0	35

APPENDIX A (continued)

County	Domestic	Municipal	Irrigation	Acres	Recreation	Industrial	Electrical	Fish and Wildlife	Drainage	Totals*
Phelps	0	823	0	0	5	0	0	0	0	828
Pike	.4	0	0	0	0	657	0	0	68	726
Platte	0	767	0	0	0	5	0	0	0	772
Polk	0	414	69	280	.1	0	0	0	0	483
Pulaski	309	413	3	10	0	0	0	0	0	724
Ray	0	657	0	0	0	0	0	0	0	657
Reynolds	32	5	0	0	.5	7	219	0	6,258	6,521
Ripley	0	0	670	655	0	0	0	0	0	670
St. Charles	.04	4,510	0	0	0	5	0	0	0	4,514
St. Francois	120	440	0	0	0	0	0	0	0	560
St. Louis	0	180	0	0	0	0	0	0	0	180
Ste. Genevieve	91	0	0	0	0	0	0	0	0	91
Saline	0	1,221	0	0	0	0	0	0	0	1,221
Schuyler	.1	1,248	758	2,904	1	0	136	0	0	2,143
Shannon	0	37	0	0	0	0	0	0	0	37
Stoddard	543	83	3,375	9,189	.4	160	0	0	0	4,163
Stone	66	0	0	0	0	0	0	0	0	66
Taney	0	108	0	0	0	0	0	0	0	108
Texas	0	314	9	45	0	0	0	0	0	323
Vernon	62	0	13	140	0	0	0	27	0	102
Warren	0	178	17	190	0	50	0	0	0	245
Washington	0	0	0	0	0	1,413	0	0	176	1,589
Webster	0	0	3	15	0	0	0	0	0	3
Wright	0	39	.02	2	2	8	0	0	0	48
Totals*	8,251	32,702	45,968	109,057	745	7,874	287,269	79	7,081	389,968

*Figures may not add to totals because of independent rounding.

APPENDIX B

1986 SURFACE-WATER USE BY COUNTY

(in million gallons per year)

County	Domestic	Municipal	Irrigation	Acres	Recreation	Industrial	Electrical	Fish and Wildlife	Drainage	Totals*
Adair	0	885	0	0	0	0	0	0	0	885
Andrew	0	0	33	250	0	0	0	0	0	33
Audrain	0	56	612	3,081	2	7	0	80	0	756
Barton	0	0	78	325	0	0	0	0	0	78
Bates	1	350	0	0	0	0	0	0	0	352
Benton	0	0	0	0	0	0	2,900,000	0	0	2,900,000
Boone	0	0	60	220	0	0	0	22	0	81
Buchanan	0	5,483	0	0	0	0	0	0	0	5,483
Butler	0	723	19	145	0	0	0	0	0	742
Callaway	5	0	83	460	0	0	22,075	0	0	22,163
Camden	0	0	52	189	0	0	0	0	0	52
Cape Girardeau	0	1,574	37	297	0	0	0	0	0	1,611
Cass	0	0	16	200	0	0	0	0	0	16
Cedar	0	0	3	100	0	0	25,340	0	0	25,343
Chariton	0	0	11	1,250	0	0	0	2	0	13
Clay	179	117	0	0	0	0	0	0	0	296
Clinton	0	176	0	0	0	0	0	0	0	176
Cole	465	162	0	0	0	52	0	0	0	679
Cooper	0	0	18	280	0	0	0	0	0	18
Dent	0	0	44	102	0	0	0	9,407	0	9,451
Dunklin	0	0	49	110	0	0	2,017	0	0	2,066
Franklin	0	0	2	100	0	0	201,663	0	0	201,664
Gasconade	0	0	15	117	0	0	0	0	0	15
Gentry	0	52	0	0	0	0	0	0	0	52
Greene	0	3,745	0	0	0	0	0	0	0	3,745
Grundy	0	8	1	80	0	0	0	0	0	9
Harrison	12	0	0	0	0	0	0	7	0	19
Henry	.2	300	0	0	0	0	0	7	0	307
Holt	0	0	1	50	0	0	0	0	0	1
Iron	0	68	0	0	0	0	0	0	2,205	2,273
Jackson	0	0	0	0	0	3,125	71,618	0	0	74,743
Jasper	1,160	776	879	2,015	0	792	0	0	0	3,607
Jefferson	0	330	0	0	0	986	0	0	0	1,316
Laclede	0	0	0	0	0	0	0	7,300	0	7,300
Lafayette	263	378	9	112	.3	19	0	0	0	670
Lawrence	0	0	19	80	0	0	0	0	0	19
Lewis	0	117	0	0	0	0	0	0	0	117
Lincoln	0	0	3	200	0	0	0	0	0	3
Linn	276	81	0	0	0	63	0	0	0	419
Livingston	0	0	0	200	0	0	0	2,259	0	2,259
McDonald	0	0	30	140	0	0	0	0	0	30
Macon	268	106	0	0	.08	115	0	0	0	490
Marion	400	30	2	40	0	295	0	0	0	727
Miller	0	0	0	0	0	0	4,470,000	0	0	4,470,000
Montgomery	0	0	5	63	0	0	0	0	0	5
Newton	.4	0	3	0	0	0	0	0	0	3
Osage	0	0	11	100	0	0	5,103	0	0	5,114
Ozark	0	0	1	20	0	0	0	0	0	1
Perry	0	77	0	0	0	0	0	0	0	77
Pike	.4	0	0	0	0	657	0	0	68	726
Platte	0	0	8	50	0	0	0	0	0	8
Polk	0	0	12	120	0	0	0	0	0	12

APPENDIX B (continued)

County	Domestic	Municipal	Irrigation Acres	Recreation	Industrial	Electrical	Fish and Wildlife	Drainage	Totals*
Pulaski	309	370	3 10	0	0	0	0	0	681
Putnam	0	118	0 0	0	0	0	0	0	118
Ralls	0	0	52 356	0	94	0	0	0	146
Randolph	0	0	0 0	0	30	0	0	0	30
Reynolds	0	0	0 0	0	0	219	0	0	219
Ripley	0	0	15 235	0	0	0	0	0	15
St. Charles	0	0	0 0	0	0	0	1,850	0	1,850
St. Louis	0	53,762	0 0	0	2,091	94,353	0	0	150,205
Schuyler	0	.01	0 0	0	0	0	0	0	.01
Scotland	77	13	0 0	0	8	0	0	0	98
Sullivan	0	260	0 0	0	0	0	0	0	260
Taney	0	162	30 160	0	0	0	5,496	0	5,689
Texas	0	0	212 120	0	0	0	0	0	212
Vernon	.7	0	265 1,519	0	0	0	37	0	302
Warren	0	0	2 53	0	0	0	0	0	2
Washington	0	0	0 0	0	1,413	0	0	0	1,413
Webster	0	0	6 55	0	0	0	0	0	6
St. Louis City	0	54,959	0 0	0	0	12	0	0	54,971
Totals*	3,414	25,238	2,701 13,004	2	9,747	7,792,398	26,467	2,273	7,962,241

*Figures may not add to totals because of independent rounding.

MISSOURI DEPARTMENT OF NATURAL RESOURCES

September 1989

G. Tracy Mehan, III, Director

DIVISION OF GEOLOGY AND LAND SURVEY

*James Hadley Williams, Ph.D., Director and State Geologist
Sarah Hearne Steelman, M.A., Deputy Director
Tami Allison, Division Secretary

ADMINISTRATION AND GENERAL SUPPORT PROGRAM

*James A. Martin, M.S., Principal Geologist and Acting Program Director
*Wallace B. Howe, Ph.D., Adjunct Professor and Research Geologist

Personnel/Fiscal Management

Carolyn Ellis, Executive I
Barbara Kennedy, Accountant I
Terry Brenner, Clerk-Typist III
Susan Davault, Clerk-Typist II

Computer Services

+Cathy Primm, B.A., Prog. Analyst III

Buildings and Grounds

Luther Fryer, Labor Supervisor
Gene Lewis, Maintenance Worker I
Carl Kuelker, Laborer I
Ellis Humphrey, Custodial Worker II

Geographic Information Systems

Gregory L. Easson, M.S., Geologist III
Kim E. Haas, Geology Technician II

Information Services

**W. Keith Wedge, Ph.D., Chief*
Arthur W. Hebrank, B.S., Geol. III
Robert H. Hansman, Ph.D., Editor
Barbara Miller, Clerk III
Jane Lea, Pub. Dist. Mgr.
Kayla Brockman, Clerk-Typist II
Gary Clark, B.S., Graphics Supvr.
Susan C. Dunn, B.F.A., Artist III
Billy G. Ross, Artist II
Phillip Streamer, Artist II
Betty Harris, Clerk-Typist II

GEOLOGICAL SURVEY PROGRAM

*Jerry D. Vineyard, M.A., Program Director and Deputy State Geologist
*James A. Martin, M.S., Principal Geologist
Sharon Krause, Clerk-Typist II

Engineering Geology

James W. Duley, B.S., Chief
James Vaughn, B.S., Soil Scien. III
David Hoffman, P.E., M.S., Geol. III
Gary St. Ivany, B.A., Geol. II
Peter Price, B.S., Geol. II
**James C. Brown, Jr., B.S., Geol. II*
Mimi Garstang, B.S., Geol. II
Myrna Reiff, B.A., Geol. II
Jim B. Fels, B.S., Geol. I
Ben Pendleton, B.S., Geol. Tech. II
Danny Sherman, Geol. Tech. I
Deborrah Breuer, Clerk-Steno III

Economic Geology

Ira R. Satterfield, M.S., Chief
Laurence M. Nuelle, M.S., Geol. III
Ardel W. Rueff, B.A., Geol. III
Bruce Netzler, M.S., Geol. III
Kenneth L. Deason, B.S., Geol. III
Joy L. Bostic, B.S., Geol. II
Michael C. McFarland, B.S., Geol. II
Evan A. Kifer, B.S., Geol. I
Jerry Plake, Lab. Tech.
Hairl Dayton, Jr., Lab. Tech.
Lois Miller, Clerk-Typist III
Rita Brasure, Clerk-Typist II
Jeffrey C. Jacques, Lab Helper

Geologic Investigations

Charles E. Robertson, M.A., Chief
Thomas L. Thompson, Ph.D., Geol. IV
Eva B. Kisvarsanyi, M.S., Geol. IV
John W. Whitfield, B.A., Geol. III
**David C. Smith, B.S., Geol. III*
James R. Palmer, B.S., Geol. III
Mark A. Middendorf, B.S., Geol. II
David M. Work, B.S., Geol. II
Cheryl M. Seeger, M.S., Geol. Tech. II
Sandra Miller, Clerk-Typist II

Environmental Geochemistry

W. Keith Wedge, Ph.D., Geol. IV
Mark A. Marikos, M.S., Geochemist

WATER RESOURCES PROGRAM

Steve McIntosh, M.S., Program Director
Mary Woodland, Clerk-Steno III
Leila Johnson, Clerk-Typist II

Groundwater Geology

Don E. Miller, M.S., Chief
James E. Vandike, M.S., Geol. III
Rex Bohm, B.S., Geol. II
Cynthia Endicott, B.S., Hydrologist II
Vacant, Clerk-Typist III

Well Driller's Support

Artney Lewis, B.S., Geol. II
Beth Marsala, Eng. Tech. II
Gary Penny, Eng. Tech. I
Edith Starbuck, M.S., Geol. Tech. I
Jerri Bixler, Geol. Tech. I
Deborah Elliott, Clerk-Typist II
Kathy Ragan, Clerk III

Floodplain Management

Richard Gaffney, M.A., Planner III
Herman Skaggs, B.A., Planner II

Economics and Water Use

Robert Clark, M.A., Planner II
Jeanette Barnett, B.S., Planner I
Mary Jo Horn, Clerk-Typist II

Surface Water

John Drew, B.S., Hydrologist II
Vacant, Hydrologist II
Charles DuCharme, B.S., Hydrologist I

River Basin Policy

Charles Michael, B.A., Chief

Water Quality

Steve McIntosh, M.S.

LAND SURVEY PROGRAM

Robert E. Myers, P.E., L.S., Program Director and State Land Surveyor
Glenda Henson, Clerk-Steno III
Bruce Wilson, B.S., Drafter II

Land Survey Projects

J. Michael Flowers, L.S., Chief
O. Dan Lashley, L.S., Project Surveyor
Robert L. Wethington, P.E., L.S., Proj. Surv.
Michael Cape, Eng. Tech. I
+Darrell Pratte, L.S., Surveyor-Parks
+Bruce D. Carter, Land Surv. Tech. II-Parks
+Richard Bates, Park Maint. Worker I-Parks

Land Corner Maintenance

Norman L. Brown, P.E., L.S., Chief
Jack C. McDermott, County Surveyor Coord.
John D. Paulsmeyer, L.S., Project Surv.
Michael Lloyd, Land Survey Tech. I
Ruth Allen, Corner Registration Clerk

Survey Document Processing

James L. Matlock, Chief
Linda Miller, Clerk-Typist III
Jane Dunakey, Clerk-Typist I

Survey Document Distribution

Diane R. Hess, Chief
Ruth A. Booker, Clerk-Typist II
Mary Davis, Clerk II

DAM AND RESERVOIR SAFETY PROGRAM

Brian J. Swenty, Ph.D., P.E., Program Director and Chief Engineer
Marge Paulsmeyer, Clerk-Typist III

Russell C. Adams, P.E., Civil Engineer
James L. Alexander, P.E., Civil Engineer
Robert A. Clay, P.E., Engineer
Ralph P. Hess, Eng. Tech. III

*Certified Professional Geologist
+Assigned to DGLS

P.O. Box 250
Rolla, MO 65401
314-364-1752